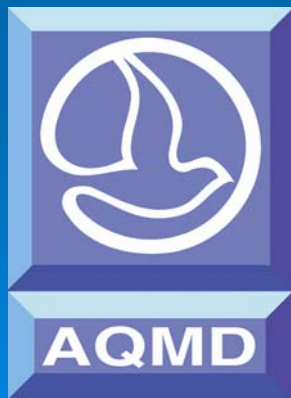


# Public Workshop for Proposed Amendments to Rule 1110.2



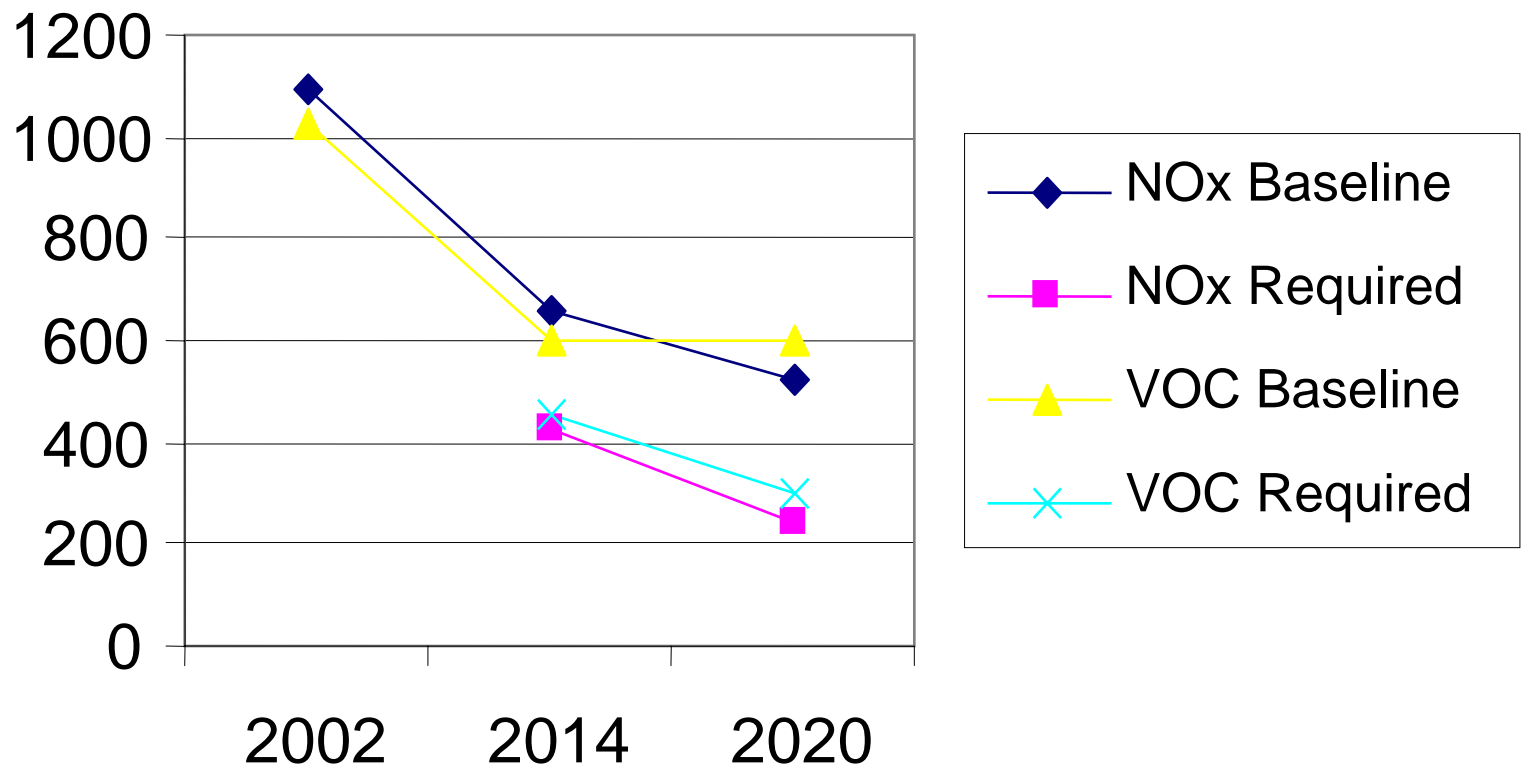
February 6, 2007  
South Coast Air Quality  
Management District

# Overview of Goals

- Improve the monitoring, recordkeeping and reporting for better compliance
- Remove obsolete portable engine requirements
- Require new distributed generation (DG) engines to meet CARB 2007 DG standards
- Reduce emissions in accordance with 2007 Air Quality Management Plan

Why are these amendments  
necessary?

# Needed NOx and VOC Reductions from Draft 2007 AQMP



# Draft 2007 AQMP

- Sufficient emissions reductions haven't been identified
- Control Measure #2007MCS-01 – Facility Modernization
  - Will require facilities to retrofit or replace their equipment to achieve BACT emission levels
  - Super-compliant VOC materials

# Engine Compliance Problems

- Unannounced emission tests of engines by AQMD
- 226 tests of old engines subject to Rule 1110.2 and new engines subject to more stringent BACT
- Engines driving compressors, pumps and electrical generators
- Engines by nine engine manufacturers or packagers

# Compliance Statistics

	<b>Rich-Burn Engines</b>	<b>Lean-Burn Engines</b>
No. of Tests	215	11
No. of ICEs Tested	180	11
% of Tests on ICEs with BACT Limits	79%	91%
% Non-Compliance	51%	27%
% NOx Violations	40%	27%
% CO Violations	28%	0%

# Emission Exceedances

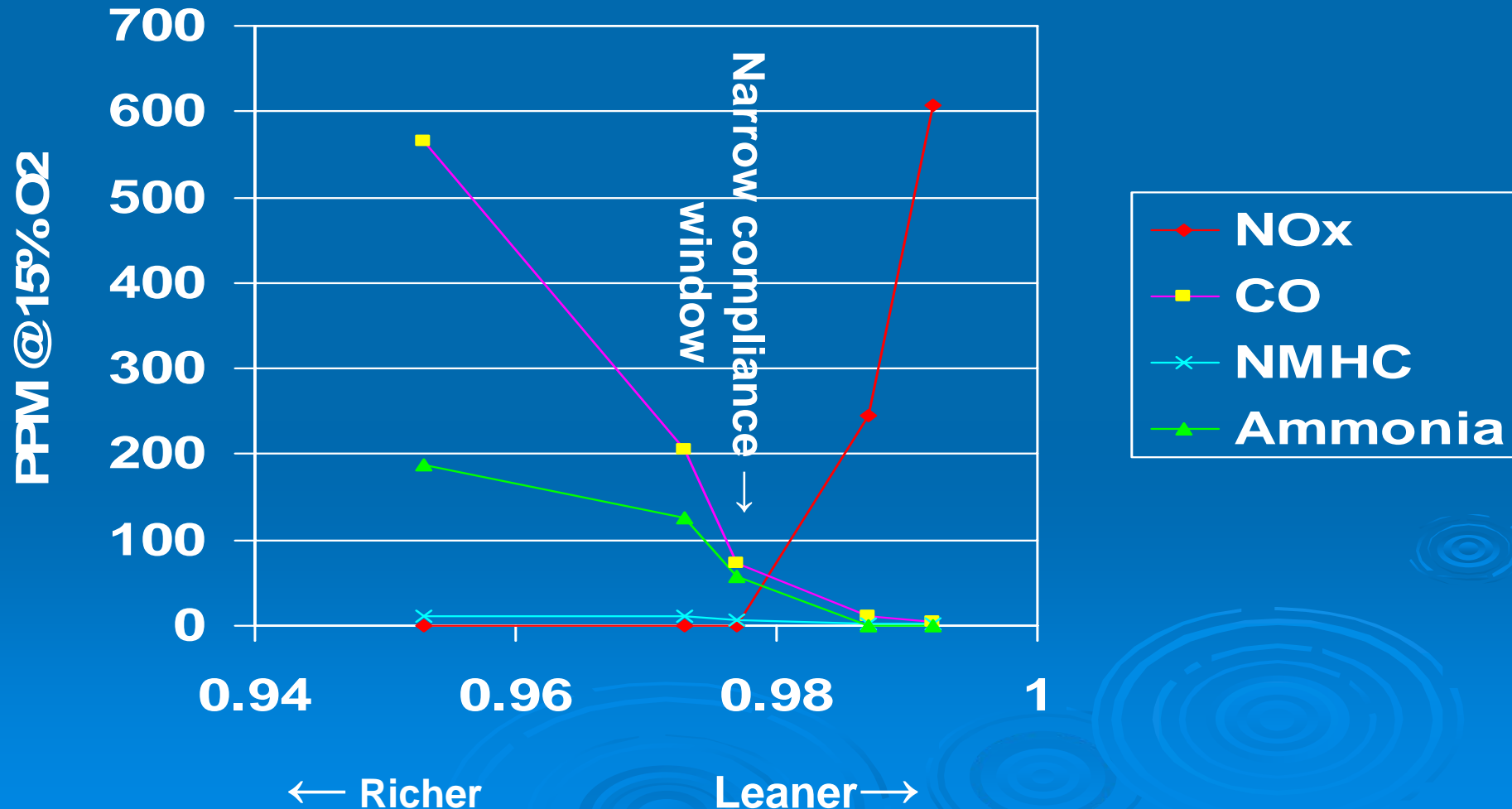
	NOx	CO
Rule 1110.2 Limits, ppm*	36-45	2000
Typical BACT Limits, ppm*	11	70
Maximum Test Concentration, ppm*	850	12,500
Average Violation Concentration, ppm*	137	2,520
Maximum % Over Limit	7,430%	18,400%
Average % Over Limit	912%	1,830%
Tested Excess Emissions, Tons/Year	385	4,894

\* @ 15% O<sub>2</sub>

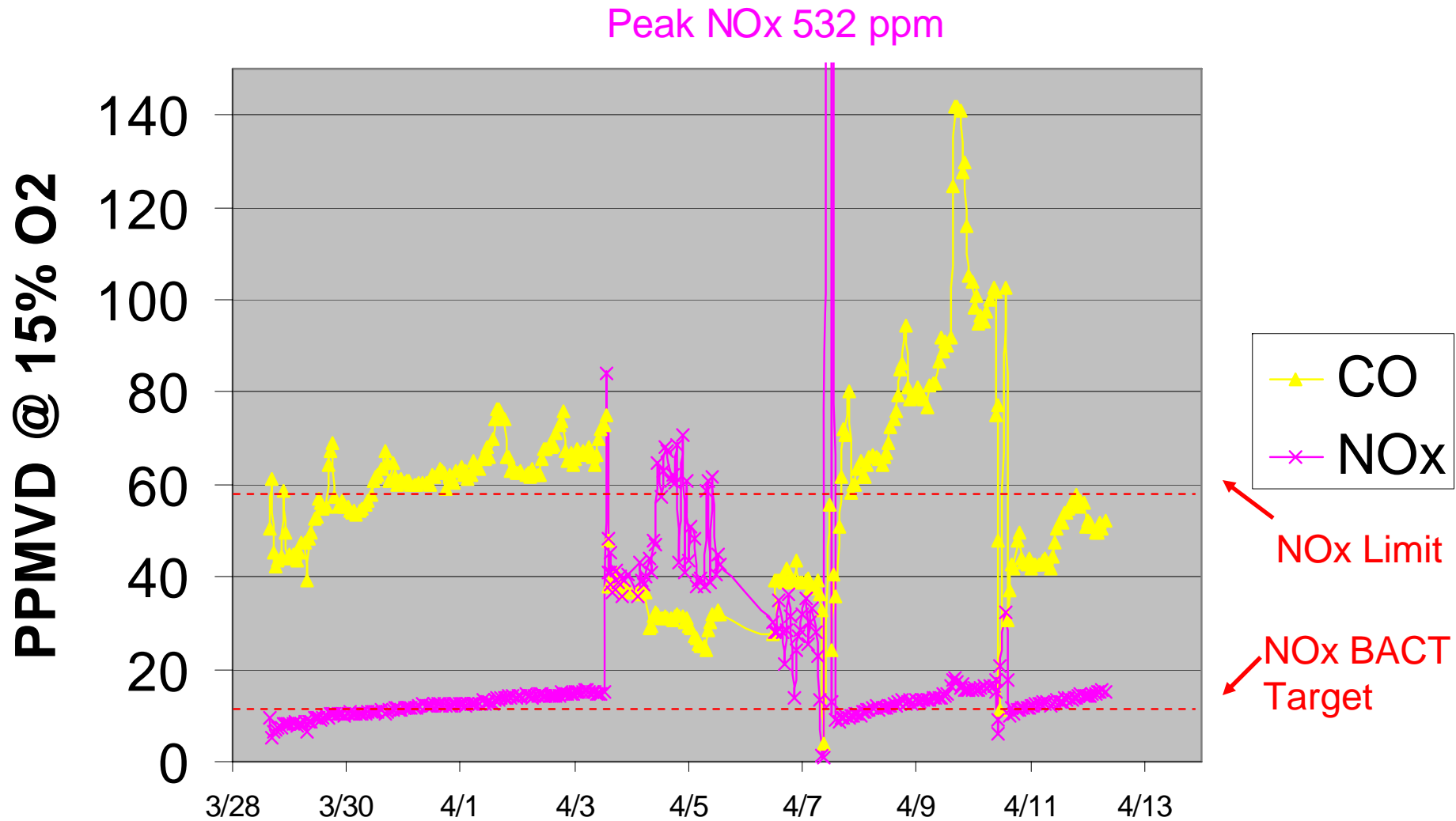


# Why So Much Non-Compliance?

# 3-Way Catalyst Controlled Engine Emissions vs. Lambda



# Stakeholders Demo Program - Emissions Data for a Modern AFRC with Dual Oxygen Sensors

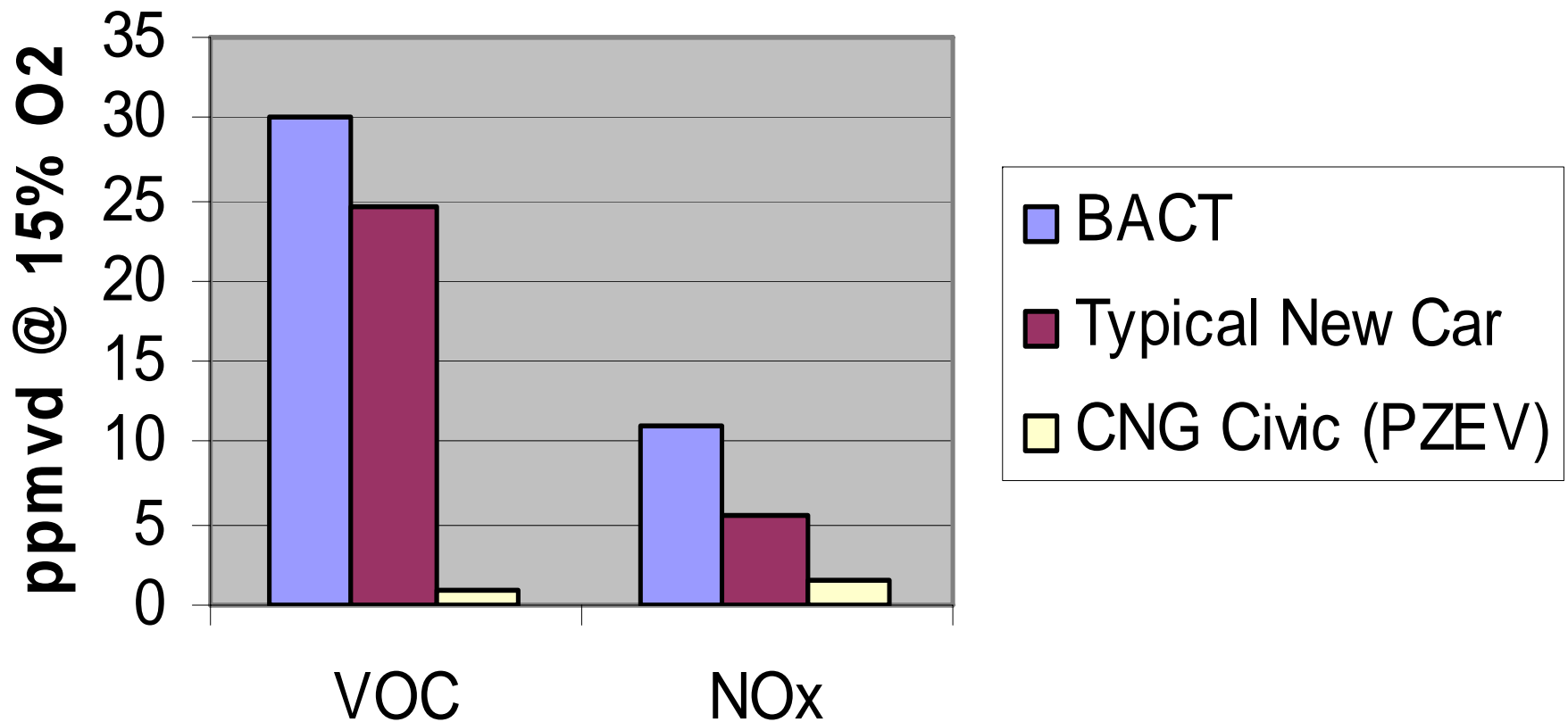


# Industry Stakeholders Demo Program Conclusion

- Current air-to-fuel ratio controllers do not keep engines in compliance, or detect non-compliance

# Why Do Cars Have a Reputation for Low Emissions and Good Reliability?

# Stationary Engine BACT Versus Vehicles



# Comparison of Stationary and Automotive Engines

## Automotive

- Engine with controls certified by engine manufacturer
- Fuel injector for each cylinder
- Sophisticated on-board diagnostics (OBD) requirements

## Stationary

- Uncertified, with engine/catalyst/AFRC from different mfrs
- Carburetor for up to 8 cylinders in one bank
- Minimal OBD

# Comparison of Stationary and Automotive Engines

## Automotive

- Upstream and downstream heated O2 sensors (HEGO)
- AFRCs use dithering and dual HEGO sensors to measure oxygen storage capacity (OSC) and determine excess emissions

## Stationary

- Often only an upstream, unheated O2 sensor (EGO)
- No dithering. AFRCs try to maintain a fixed EGO set point. Can't measure OSC or determine excess emissions



# Comparison of Stationary and Automotive Engines

## Automotive

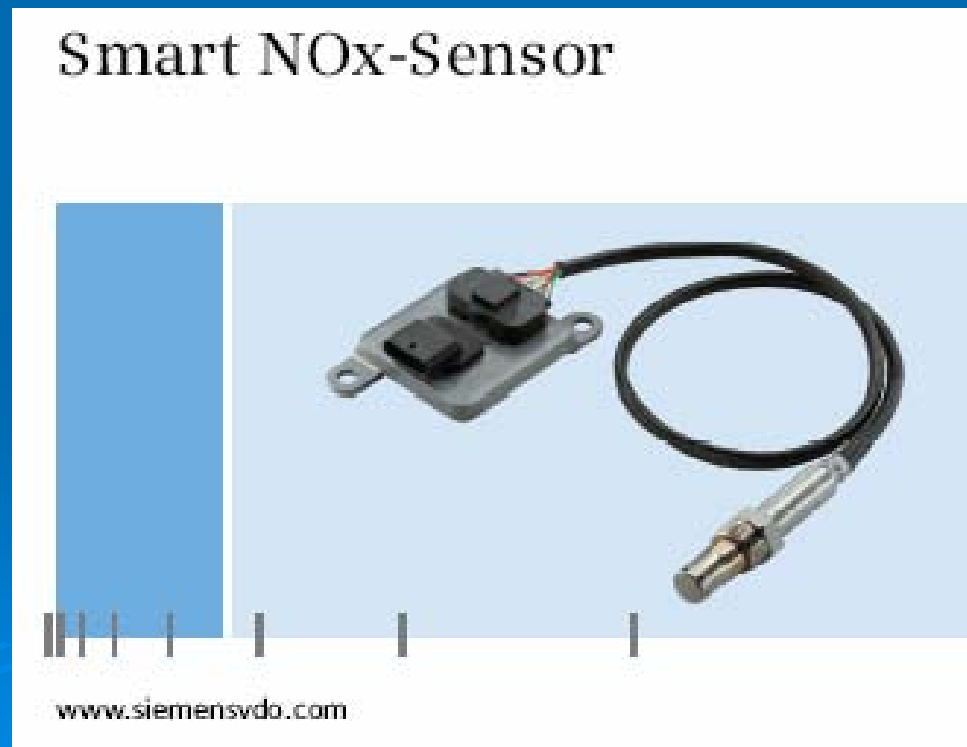
- Wider air-to-fuel ratio (AFR) window with gasoline
- Honda CNG Civic
  - Two specially-designed HEGOs:
    - One to counter lean shift from H<sub>2</sub> in upstream exhaust
    - Another to counter rich shift from methane in downstream exhaust

## Stationary

- Narrower AFR window with natural gas
- Ordinary EGOs for gasoline engines

# Rich-burn AFRC Conclusions

- Better AFRCs for stationary rich-burn engines are needed
- The Future?



# Affected Sources and Emission Inventory (Tons per Day)

- About 940 stationary non-emergency engines

	<b>NOx</b>	<b>VOC</b>	<b>CO</b>
Emissions if engines were in compliance	3.29	1.47	11.2
Estimated Excess Emissions	1.29	5.40	21.7
Totals	4.58	6.87	32.9

# What Amendments Are Proposed to Improve Compliance?

# Proposed Amendments to Monitoring, Recordkeeping and Reporting

## ➤ Continuous Emission Monitoring

- Put CO CEMS requirement back in rule (deleted by 1997 rule)
- Require CEMS for engines with a combined rating of 1000 hp or more in one location (within 75 ft)
  - Time-sharing allowed for additional CEMS
- Compliance with Rule 218

# Proposed Amendments – Source Testing

- Increase frequency from every 3 years to every 2 years (or 8760 hrs operation).
- Multiple load tests
- No pre-test adjustment, no abort for non-compliance
- Submit protocol, give 30-day notice, submit results within 30 days
- Provide sampling facilities (Rule 217)

# Proposed Amendments – Inspection and Monitoring (I&M) Plan

- I&M Plan required by CARB & EPA
- Required for engines with no CEMS
- Submit plan by 1/1/08; implement 5/1/08
- Determine parameter ranges for emission compliance over engine load range
  - O2 sensor voltage, Cat T's, reagent rate (if SCR)
  - initially and, for rich-burn engine, whenever O2 sensor changed

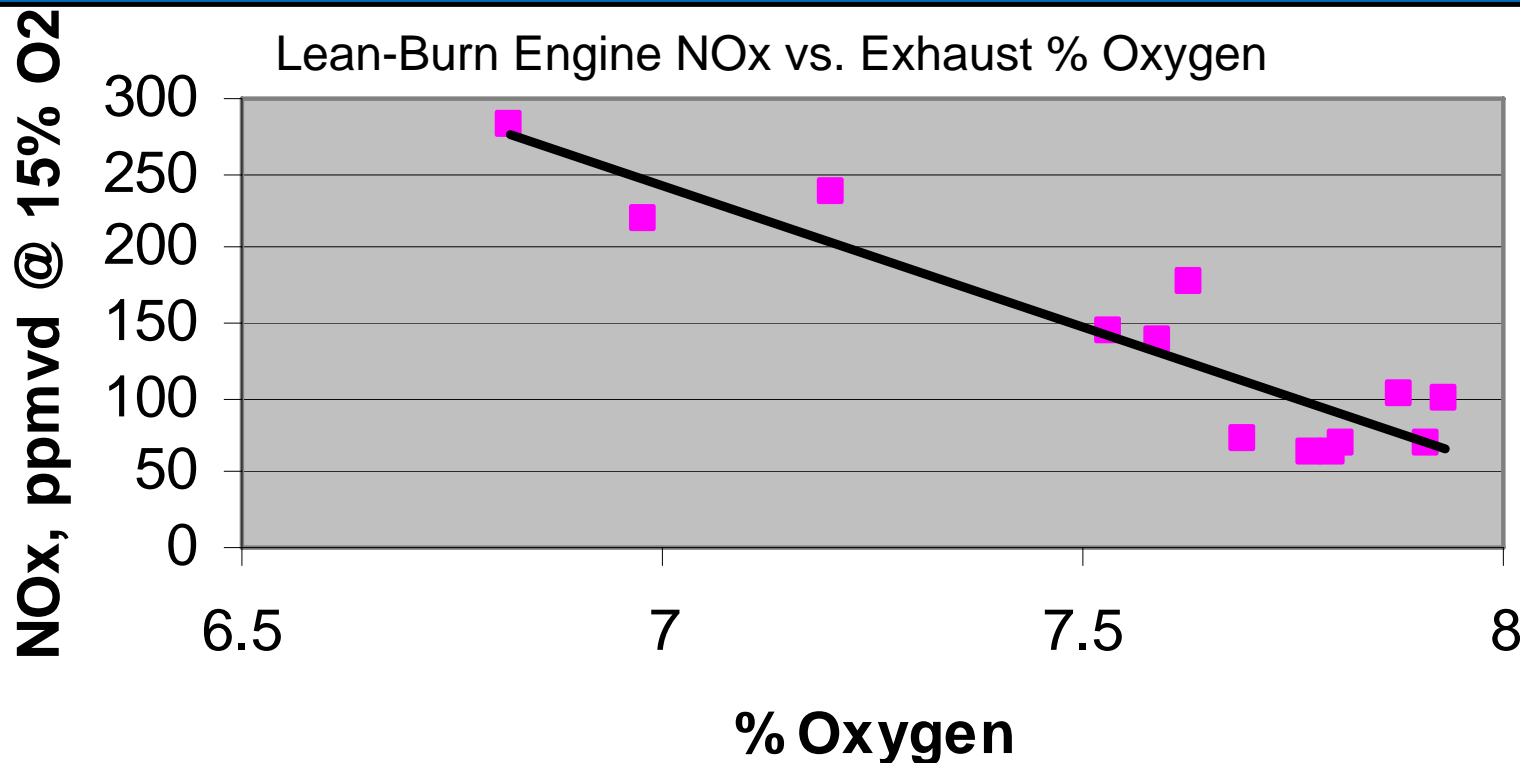
# I&M Plan (cont.)

- Daily monitoring and recording of engine and control equipment parameters, faults and alarms
- Emission checks weekly (or 150 hrs) using portable analyzer
  - Monthly (or 750 hrs) if three successive weekly tests OK
- Preventative and corrective maintenance and schedules
- Portable Analyzer Training



# Proposed Requirements – Air-to-Fuel Ratio Controllers (AFRC)

- AFRCs with O<sub>2</sub> sensor and feedback control
- For engines without CEMS, even lean-burns:



# What Amendments Are Proposed to Lower Emission Limits?

# Proposed Amendments to Requirements – Efficiency Correction

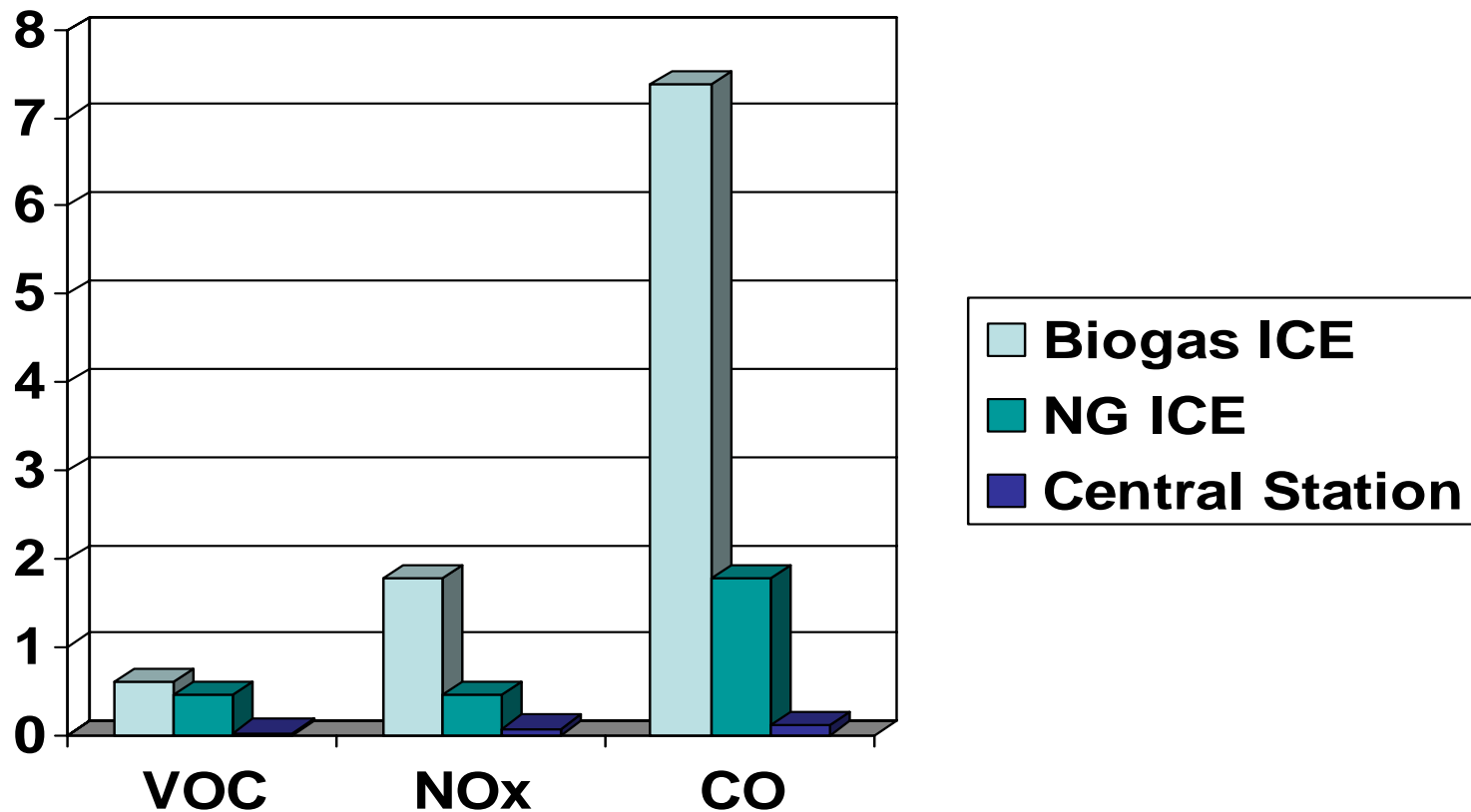
- Eliminate efficiency correction because it is difficult to determine, and often ignored.
- Unnecessary for three-way catalyst equipped engines (CARB BARCT is 25 ppm without efficiency correction)
- Excludes engines using at least 90% landfill or digester gas
  - Operator must demonstrate claimed efficiency using ASME test procedure

# Proposed Amendments to Requirements – Future Reduction to BACT Levels

- Limits drop to 11 ppm NO<sub>x</sub>, 30 ppm VOC, 70 ppm CO at 15% O<sub>2</sub>:
  - Natural gas, diesel, field gas ≥500 hp – 7/1/2010
  - Natural gas, diesel, field gas <500 hp – 7/1/2011
  - Landfill or digester gas – 7/1/2012

# BACT for Biogas ICEs, Nat Gas ICEs vs. Central Generating Station BACT (lbs/MW-hr)

Biogas engines emissions are high and need to be reduced.

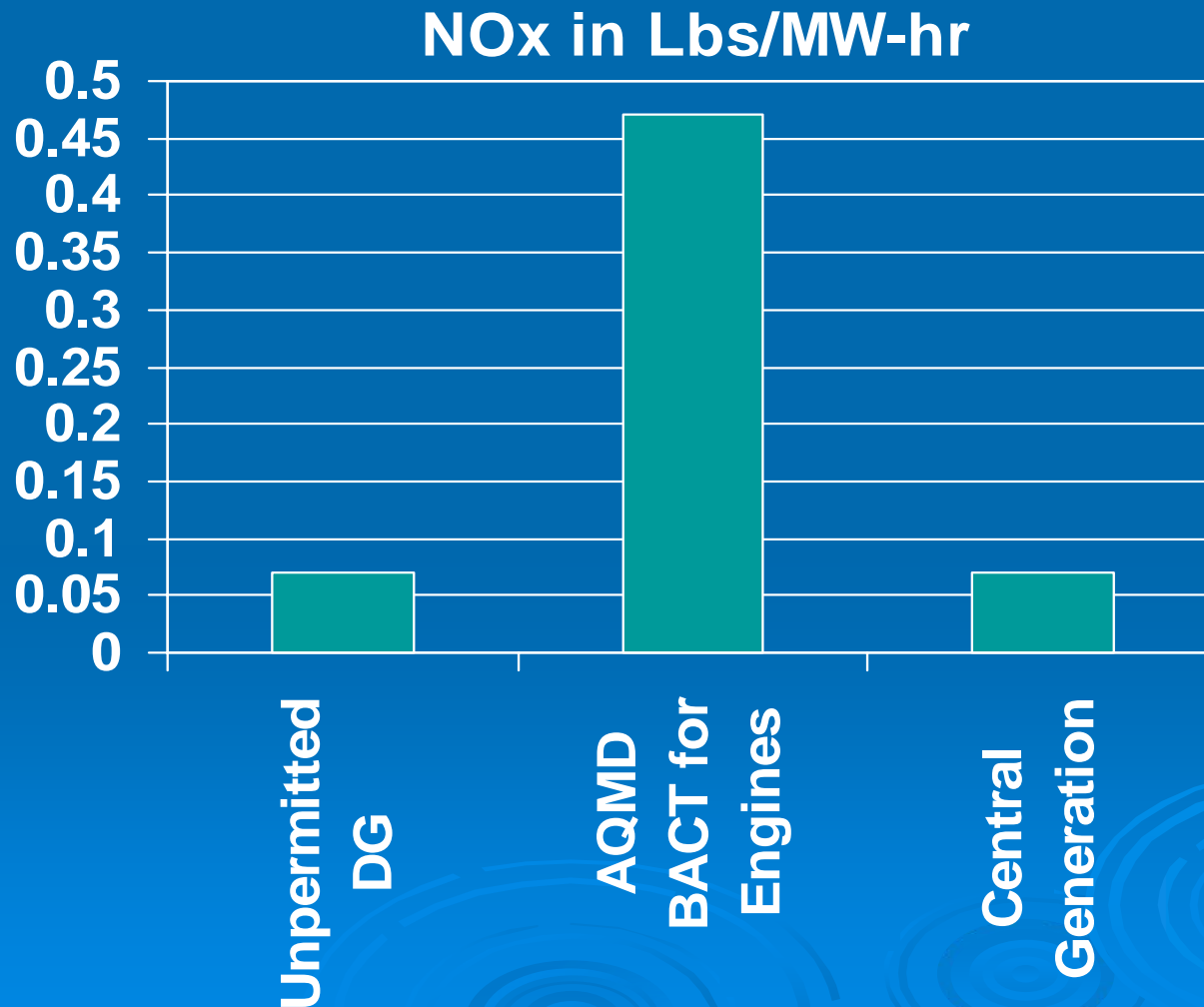


# New Technologies to Reduce Biogas Engine Emissions

- Biogas cleanup to allow use of SCR and oxidation catalysts
- Non-catalytic NOx/VOC/CO controls:  
NOx Tech
- Biogas cleanup to make pipeline gas or natural gas vehicle fuel
- Microturbines, fuel cells, gas turbines, boilers

# Distributed Generation

# Electrical Generator Emissions Comparison





# CARB 2007 DG Standards

	lb/MW-hr	Equivalent ppm @ 15% O <sub>2</sub> **
NO <sub>x</sub>	.07*	1.6-4.0
CO	0.1*	3.7-9.3
VOC	.02*	1.3-3.2

\*CHP credit of 1 MW-hr per 3.4 MMBtu of waste heat recovered

\*\* HHV efficiency range: 28%-70%

# Proposed Amendments to Requirements – Distributed Generation

- New stationary, non-emergency generators must meet CARB 2007 standards (lb/MW-hr)
- Credit for waste heat utilization @ 1 MW-hr per 3.4 MMBtu recovered and utilized
  - Net power production and waste heat utilization must be determined daily and reported annually.
- Does not apply to engines using at least 90% landfill or digester gas.

# Other Amendments

# Proposed Amendments - Exemptions

- Exempt start-up emissions until sufficiently warmed up, not to exceed 15 minutes
  - Additional CEMS startup data are welcomed
- Emergency Engines
  - Combine flood control and fire-fighting with other emergency uses
  - Limit to 200 hours/yr
  - Require limits on permits

# Proposed Amendments to Requirements – Portable Engines

- Federal preemption of local emission standards
- Current rule exempts nonroad engines; includes portable engines
- Proposed Amendments:
  - Delete current emission limits
  - Reference CARB regulations for diesel and spark-ignited engines

# Proposed Amendments - Recordkeeping and Reporting

- Recordkeeping of data, logs, test reports, actions and other information required by the rule
- Reporting of non-compliance within one hour of discovery
- Follow breakdown procedures of Rule 430

# Proposed Amendments to Compliance Subdivision

- Removal of obsolete compliance dates
- Existing Engines
  - Add compliance schedules for new requirements
- New Engines
  - Require compliance upon installation

# Proposed Amendments to Definitions

- New definitions for “Net Electrical Energy” and “Useful Heat Recovered” to support DG emission standards
- New definitions for “Oxides of Nitrogen” and “Rich-Burn Engine with a Three-Way Catalyst”



# Compliance Options

Operators will have several choices to comply:

- Retrofit emissions controls on existing engines, or
- Use cleaner technologies such as, fuel cells, microturbines, gas turbines or zero-emission electric motors
- Buy grid power

# Cost Effectiveness

- Average Incremental Cost: \$5,840 per ton
- Range of Costs: \$15 to \$125,000 per ton
- More options for biogas to be evaluated
- Electrification Costs (\$/ton):

	Average	Incremental
Average	\$6,870	\$18,600
Range	\$2,800 - \$82,700	-\$109,000 - \$57,400

# Process and Schedule

- Written comments due: Feb 16, 2007
- Set public hearing date: May 4, 2007
- Public Board hearing: June 1, 2007